

Design Flows, Septic and Grease Interceptor Tanks and Effluent Distribution, Pump Systems & Air Injection Processes

Technical Standards Section IV- VI

Sewage Flows or Design Flows Section IV (pg. 24)

- What is a design flow?
 - The estimated daily flow expected from a building
 - Measured in gallons per day (GPD)

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Design Flows Section IV (pg. 24)

- A SSDS must be sized to accommodate the flows from a building based on maximum possible occupancy, bedrooms, gross area, seats, metered flows, etc.
- Flows are determined based on building use.

Does everyone have a calculator?

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Design Flows

Section IV (pg. 24)

- Residential Buildings- homes, apartment buildings, condos, townhouses, etc.
 - Single family home-150 GPD per bedroom up to 4 bedrooms, 75 GPD for each bedroom thereafter.
 - Multi-family- 150 GPD per bedroom
 - 50 gallons per person per day times a safety factor of 1.5= 75 GPD per person
 - 75 GPD times two persons per bedroom

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Design Flows

Section IV (pg. 24)

- Nonresidential Buildings and Residential Institutions- schools, restaurants, office, factory, group home, etc.
 - Table No. 4
 - Specific water use data times safety factor of 1.5

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Section IV. Design Flows (pg. 24)

- Nonresidential buildings: Design flows based on metered water usage data and must include a minimum of 1 year of readings. If flows are based on comparison to a similar facility it must be supported by documentation (building size, fixture info, hours of operation, etc.).

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Section IV. Design Flows (pg. 24-25)

- Table No. 4 is not all inclusive
 - Strength and nature of the wastewater must be taken into consideration
 - Strong
 - Medium
 - Weak
 - Reference made to application rates included in Table No. 7 (Restaurants, Residential Institutions, High Strength/Problematic Sewage), and in Table No. 8 (Other nonresidential buildings).
 - Discuss more later

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Design Flows Section IV (pg. 25-26)

- Table No. 4- determining daily design flow
 - Schools, per pupil
 - Commercial/Industrial building per employee
 - Camp
 - Health Care Facilities
 - Restaurants
 - Recreation Facilities
 - Churches
 - Miscellaneous

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Table No. 4

<u>Building Type</u>	<u>Table No. 4</u>	<u>Design Flow (GPD)</u>
<u>Schools, per pupil</u>		
Base Flow (Excludes Kitchen & Showers)		
High School		12
Junior High/Middle School		9
Kindergarten/Elementary School		8
Day Care Center		10
Additional Flows for Kitchen & Showers		
Kitchen (Table No. 7 Applic. Rate)		3
Showers		3
Residential		100

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Table No. 4

Commercial Buildings**

Office (Average 200 sq. ft. gross area/person), per employee	20
Retail/Supermarket Building*, per sq. ft. gross area	0.1
*Supermarkets must increase design flow to account for delis and bakeries	
Deli and bakery flow: (Table No. 7 Applic. Rate)	
Industrial Building, per sq. ft. of gross area	0.1
Factory (Average 200 sq. ft. gross area/person), per employee	25
(Add 10 GPD for showers)	
**Design flows may be reduced if documentation (building/floor plans, statement of use, etc.) supports the reduction	

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Section IV Design Flows pg. 24-25

Subsection B, Table 4

- Commercial building category
 - Design flows may be reduced if documentation (building/floor plans, statement of use, etc.) supports reduction.
 - Industrial building design flow (0.1 GPD/SF of gross floor area) added
 - Factory design flow stipulates that the # of persons is based on 1 person per 200 square feet of floor area.

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Table No. 4

Camps/Family Campgrounds --

Residential Camp (Semi permanent), per person	50
Campground with Central Sanitary Facilities, per person	35
Campground per Camp Space (Water and sewer hook-ups)	75
Day Camp, per person	15
Picnic Park (Toilet wastes only), per person	5
Picnic Park with Bathhouses, Showers, Flush Toilets, per person	10

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Table No. 4

Residential Institutions (Table No. 7 Applic. Rate)

Hospital, per bed	250
Rest Home, per bed	150
Convalescent Home, per bed	150
Institution, per resident	100
Residential motels/hotels, per room	150
Group Home/Community Living Arrangement, per client*	100-150**
*Use maximum occupancy unless state license restricts occupancy & requires local health department approval in accordance with PHC Section 19-13-B100a for occupancy increases	
**Use higher flow for large tub/on-site laundry	

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Table No. 4

Restaurants, Food Service Establishments and Bars (Table No. 7 Applic. Rate)

Restaurant (Public toilets provided), per seat	30*
Restaurant (No public toilets), per seat	20*
*Design flow shall be increased by 50% if breakfast, lunch & dinner are provided	
Take-out Food Service, per meal served	5
Bar/Cocktail Lounge (No meals), per seat (Table No. 8 Applic. Rate)	15

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Table No. 4

Recreational Facilities

Swimming pool, per bather	10
Tennis Court, per court: indoor/outdoor	400/150
Theater, Sport Complex, per seat	3.5

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Table No. 4

Church/Religious Building

Worship Service, per seat	1
Sunday School, per pupil	2
Social Event (Meals served), per person (Table No. 7 Applic. Rate)	5

Miscellaneous

Auto Service Station, per car serviced	5
Salon, (Table No. 7 Applic. Rate)	
Per styling chair/station (hair)	200
Per pedicure chair/spa (5 gallon maximum basin)	100
Per manicure chair/station	50
Barber Shop, per chair	50
Dental/Medical Office with Examination Rooms, per sq. ft. of gross area	0.2
Dog Kennel, per run (Roof must be provided) (Table No. 7 Applic. Rate)	25
Laundromat (Commercial; Require DEP Permit), per machine (Table # 7 App. Rate)	400
Motel (Transient, No Food Service, Kitchenette or Laundry Facilities), per room	75
Motel (Transient, With Kitchenette but no Laundry Facilities), per room	100
Marina (Bath-house & Showers Provided), per boat slip	20



Design Flows Section IV (pg. 25-26)

- Example calculations:
- 200 student middle school with showers, no kitchen.

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Table No. 4

Building Type	TABLE NO. 4	Design Flow (GPD)
Schools, per pupil		
Base Flow (Excludes Kitchen & Showers)		12
High School		9
Junior High/Middle School		9
Kindergarten/Elementary School		8
Day Care Center		10
Additional Flows for Kitchen & Showers		
Kitchen (Table No. 7 Applic. Rate)		3
Showers		3
Residential		100

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Calculations

$$9 + 3 = 12 \text{ GPD per student}$$

$$200 \times 12 = 2,400 \text{ GPD}$$



Calculations

10,000 SF Office Building

Commercial Buildings**

Office (Average 200 sq. ft. gross area/person), per employee

Retail/Supermarket Building*, per sq. ft. gross area

*Supermarkets must increase design flow to account for delis and bakeries

Deli and bakery flow: (Table No. 7 Applic. Rate)

Industrial Building, per sq. ft. of gross area

Factory (Average 200 sq. ft. gross area/person), per employee

(Add 10 GPD for showers)

**Design flows may be reduced if documentation (building/floor plans, statement of use, etc.) supports the reduction

20

0.1

0.1

25



Calculations

■ 10,000 Square Feet (SF) Office Building

- 10,000 SF/200 per employee = 50 employees

$$50 \text{ (employees)} \times 20 \text{ GPD} = 1,000 \text{ GPD}$$



Calculations

10,000 SF Commercial/Retail

Commercial Buildings**

Office (Average 200 sq. ft. gross area/person), per employee	20
Retail/Supermarket Building*, per sq. ft. gross area	0.1
*Supermarkets must increase design flow to account for delis and bakeries	
Deli and bakery flow: (Table No. 7 Applic. Rate)	
Industrial Building, per sq. ft. of gross area	0.1
Factory (Average 200 sq. ft. gross area/person), per employee	25
(Add 10 GPD for showers)	
**Design flows may be reduced if documentation (building floor plans, statement of use, etc.) supports the reduction	

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Calculations

■ 10,000 SF Retail/Commercial

$$10,000 \text{ SF} \times 0.1 \text{ GPD/SF} = 1,000 \text{ GPD}$$

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Calculations

100 Seat restaurant serving lunch and dinner w/ toilets.

Restaurants, Food Service Establishments and Bars (Table No. 7 Applic. Rate)

Restaurant (Public toilets provided), per seat	30*
Restaurant (No public toilets), per seat	20*
*Design flow shall be increased by 50% if breakfast, lunch & dinner are provided	
Take-out Food Service, per meal served	5
Bar/Cocktail Lounge (No meals), per seat (Table No. 8 Applic. Rate)	15

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Calculations

100 Seat restaurant (Class 3) serving lunch and dinner w/ toilets.

$$100 \text{ (seats)} \times 30 \text{ (GPD per seat)} = 3,000 \text{ GPD}$$



Calculations

- Specific water use data
 - One year minimum metered flows times 1.5 safety factor
 - Non-residential buildings and Residential Institutions



Calculations

- 5 area McD's Restaurants approximately the same size, number of seats, and hours of operation.
 - Average Flows:
 - 2,250 GPD
 - 2,600 GPD
 - 1,955 GPD
 - 1,800 GPD
 - 2,475 GPD



Calculations

$$\begin{array}{r} 2,250 \text{ GPD} \\ 2,600 \text{ GPD} \\ 1,955 \text{ GPD} \\ 1,800 \text{ GPD} \\ + 2,475 \text{ GPD} \\ \hline 11,080/5 = 2,216 \end{array}$$

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Calculations

- Average Daily Flow = 2,216 GPD

$$2,216 \times 1.5 \text{ (safety factor)} = 3,324$$

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Design Flows (pg. 26)

- Water usage monitoring: Large systems (2000 GPD or greater) must have the ability to monitor potable water supply usage
- Permits to discharge: Must be approved forms. Form #4 or approved equal. Permits shall reference design flow, permitted flow and recommend the average flow not exceed 2/3 of the design flow.

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Design Flows (pg. 26)

- Management programs: Proposed ordinances or regulations for sewer avoidance programs or wastewater management districts must be sent to DPH for review.

C. Water usage monitoring

Buildings served by large (2,000 GPD or greater) subsurface sewage disposal systems must have the ability to monitor potable water usage by metering of the source of supply.

D. Permits to discharge

Permits to discharge issued by the local director of health shall be on approved forms (Form #4 or approved equal) as required by PHC Section 19-13-B103e (h). The discharge permits shall specify the design flow and permitted flow. The design flow shall equal the permitted flow, except for non-compliant repairs with limited leaching systems. The permitted flow for non-compliant repairs shall be determined using the most limited percentage of the required ELA and/or MLSS provided. The discharge permit should recommend the average daily discharge not exceed 2/3 of the permitted flow in order to allow the subsurface sewage disposal system to operate with a sufficient factor of safety.

E. Management programs

Local health departments and municipalities implementing decentralized sewage system management programs (i.e., Sewer Avoidance and Pump Out Ordinances, Decentralized Wastewater Management Districts, etc.) shall submit proposed ordinances and regulations to the Commissioner of Public Health for review and approval prior to adoption.



Section V: Septic Tanks and Grease Interceptor Tanks

Section V Septic Tanks (pg. 26)



Concrete Tank

Section V Septic Tanks (pg. 26)



Plastic Tank



Septic Tank Standards

- All SSDS must have a septic tank
- Tanks and risers under traffic areas must be rated for H-20 wheel loading
- Concrete: Must not be shipped prior to 14 days without support documentation
- Concrete: Conform to ASTM C 1227 with exceptions.



Non-Concrete Septic Tanks

- Must be installed per manufacturers specifications.
- Tank bottoms located in groundwater must have anti-buoyancy / flotation provisions
- Appendix D

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Section V

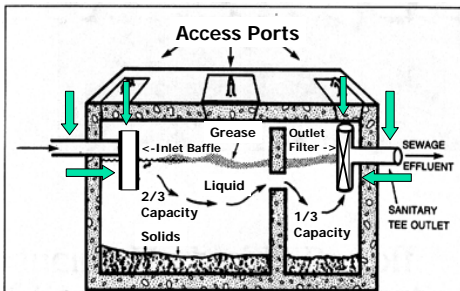
Septic Tanks (pg. 27)

- Tank Configuration
 - Inlet and outlet baffles
 - Inlet submerged to a depth of 8 to 18"
 - A ½" air space above baffles must be provided
 - Inlet and outlet piping exiting the tank shall be set as level as possible with a pitch no greater than ¼" per foot

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Septic Tank



Septic Tanks (pg. 27)

- Baffles: Connecting polyethylene (PE) baffles (i.e., Polylok) to poly-vinyl chloride (PVC) pipe requires use of appropriate 2-step cement (ASTM D 3138) for dissimilar plastic piping materials.

Sewage Flows, Septic and Grease
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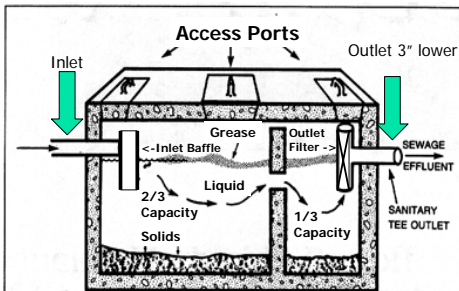
Section V Septic Tanks (pg. 27)

- Tank Configuration
 - Inlet and outlet baffles
 - Inlet and outlet inverts:
 - Outlet 3 inches lower (precast)
 - Outlet 2-4 inches lower (installed)

Sewage Flows, Septic and Grease
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Septic Tank



Section V Septic Tanks (pg. 27)

- Tank Configuration
 - Inlet and outlet baffles
 - Inlet and outlet inverts:
 - -Outlet 3 inches lower (precast)
 - -Outlet 2-4 inches lower (installed)
 - Tank outlet must be set higher than top of leaching system or high level overflow to avoid backup.

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Tank outlet above top of leaching gallery



Sewage Flows, Septic and Grease
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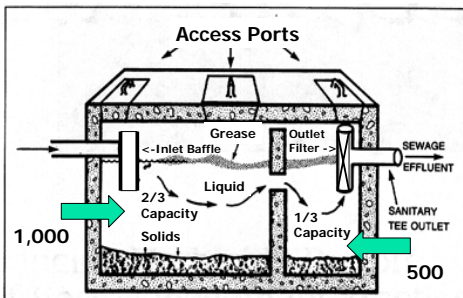
Two Compartment Tank

- Two compartments
 - Two thirds capacity inlet side
 - One third capacity outlet side

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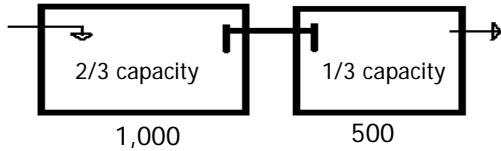
Septic Tank 1,500 gallons



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Septic Tanks

- Two single compartment tanks in series
 - 1500 gallons total



Septic Tanks

- Septic tanks and grease interceptor tanks, including riser and cover assemblies, under vehicular travel areas must be H-20 minimum ratings.
- Septic tank manufacturers must file updated specifications with DPH by July 1, 2009.

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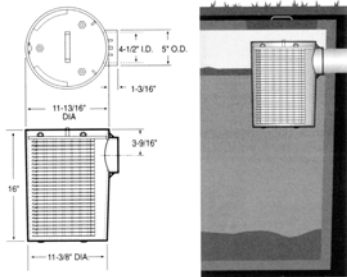
Effluent Filter (Appendix B)

- Protects leaching system from solids
- Must be cleaned at time of pump out
- Many different types approved by DPH

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Effluent Filter



Effluent Filter



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Noxious Septic Tank Gas



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Septic Tank Access (pg. 28)

- Manholes
 - 17 inches minimum diameter
 - Required for each compartment (if a filter is present)
 - Depth not greater than 12 inches below finished grade
 - Tanks in paved areas and 2000 gallons or more (non-residential) manholes must extend to grade

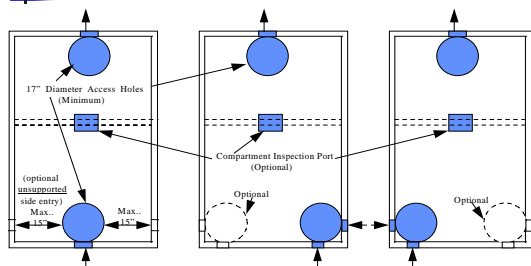
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Septic Tank Access



Septic Tank Access



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Septic Tank Risers

- Needed on all new construction and at the time of cleaning for older tanks if manholes are greater than 12 inches below finished grade.
- Risers and manhole extensions must be constructed to prevent storm water infiltration.
- Covers to grade
 - Minimum 59 pounds
 - Locking system

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Septic Tank Risers





Septic Tank Cleaning (pg. 29)

- Recommended every 3 to 5 years but as often as necessary to prevent build-up of sludge, grease and scum
- Remove sludge, scum, solids and other septage
- Clean filter and inspect baffles
- Tanks to be cleaned by Licensed Septic Pumpers or Installer.

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Septic Tank Cleaning



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Septic Tank Cleaning (pg. 29)

- **Septic Tank Cleaning**
 - Backflow conditions at time of tank pump-out under normal use conditions represent a “malfunctioning” condition.
 - Recommend further system assessment by PE or installer.
 - “Failed” systems discharge effluent to ground surface or otherwise cause health hazards or nuisance conditions.

Sewage Flows, Septic and Grease
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Septic Tank Cleaning

- **Septic Tank Pumping**
 - Lower liquid level first to avoid sludge/scum from flowing to leaching system.
 - All scum and sludge must be removed. Baffles must be inspected for damage or clogging at time of pumping.
 - Avoid damaging system and clean up spills.

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Septic Tank Markings (pg. 29)

- Located on outlet side of tank
- Manufacturer or precasters name
- Size (i.e., 1250 Gallons)
- Date Manufactured (i.e., 9/26/06)
- Load Limits (i.e., Max. cover 3 feet)
- Gas Warning: Entrance into the tank could be fatal.

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Performance Testing

- Leak testing
 - Vacuum Test
 - Water-Pressure Test

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Sizing Septic Tanks (pg. 30)

- Minimum size septic tank is 1,000 gallons
- Sizing septic tanks for residential buildings are based on bedrooms
 - 3 or fewer bedrooms 1,000 gallon tank

Minimum Septic Tank Capacities for Residential Buildings

	Single-family	Multi-family
1-3 bedrooms	1,000 gallon	1,000 gallon
4 bedrooms	1250 gallons	1250 gallons
For each bedroom beyond 4	Add 125 gallons per bedroom	Add 250 gallons per bedroom

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Sizing Septic Tanks (pg. 30)

- Garbage grinder add 250 gallons (Note: not recommended)
- Large tub 100 gallons add 250 gallons to septic tank size
- Large tub over 200 gallons add 500 gallons to septic tank size.

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Sizing Septic Tanks for Residential Buildings

- 5 bedroom single family house
 - 1250 gallons for four bedrooms
 - Add 125 for each bedroom after 4

1250 (first 4)
+125 (each bedroom after 4)
1375 minimum gallons

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Sizing Septic Tanks for Residential Buildings

- Calculations
 - 24 Bedroom apartment building
 - 1250 for the first 4 bedrooms

1,250 (first 4 bedrooms)
+5,000 (20 bedrooms times 250 for multi-family)
6,250 gallons

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Sizing Septic Tanks for Non-residential Buildings and Residential Institutions

- Minimum capacity equal to the 24 hour design flow, but not less than 1000 gallons.
 - Restaurants without grease removal, the septic tank must increase capacity by 50%
 - If high peak flow conditions exist a 2 hour minimum detention time must be used for sizing septic tank

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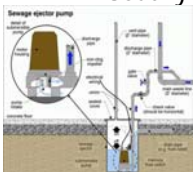
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Sizing Septic Tanks for Non-residential Buildings and Residential Institutions

- High Peak Flow Conditions
 - Theater: Monday-Friday 200GPD
Saturday-Sunday 2000GPD
 - Peak intermission Flow=500 Gallons/30 minute
$$\frac{500 \text{ Gallons}}{0.5 \text{ hrs}} = \frac{X \text{ Gallons}}{2 \text{ hrs}}$$
$$X = 2,000 \text{ gallons}$$

Septic Tank Sizing: Ejector Pumps

- Tank size to increase if more than 25% of the design flow is to be ejected into the septic tank using a pump
- Usually only for basement fixtures



Sewage Flows, Septic and Grease Interceptor Tanks, Distribution, Tech Standards Section IV - VI



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Grease Interceptor Tanks (pg. 30)

- Required on all new restaurants with design flow of 500 GPD or more.
- If a grease interceptor tank can not be installed a mechanical automatic grease recovery unit (AGRU) can be installed.
- If a grease interceptor tank and an AGRU can not be installed increase septic tank size by 50%.

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Grease Interceptor Tanks

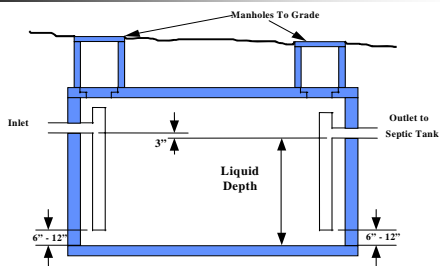
- Usually one compartment
- Deeply baffled
- Manhole to grade

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Grease Interceptor Tanks



Sewage Flows, Septic and Grease
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Grease Interceptor Tanks

- Receive only kitchen wastewater
- Restroom wastewater is directed to the septic tank

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Sizing Grease Interceptor Tanks

- Minimum Capacity equal to the 24 hour design flow volume in gallons.
- Not less than 1000 gallons
- Design flow of 2,000 or more requires two grease interceptor tanks in series.

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Section VI: Effluent Distribution, Pump Systems & Air Injection Process



Effluent Distribution, Pump Systems & Air Injection Process (pg. 31)

- Three way to distribute effluent:
 1. Gravity
 2. Pump
 3. Siphon

Distribution method must:

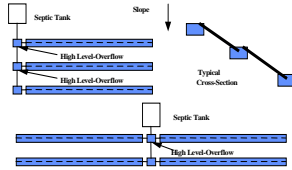
- Promote uniform distribution
- Fully utilize leaching system
- Allows for air transfer

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Effluent Distribution, Pump Systems & Air Injection Process (pg. 31)

- Serial systems: High-level overflows must be set in the upper 3 inches (0.25 feet) of the leaching structure. This will assist in leaching system venting. Leaching galleries no longer are required to flood to top of structure.



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Effluent Distribution, Pump Systems & Air Injection Process (pg. 31)

- Leaching system venting: leaching systems should be designed to allow for air/gas transfer. Effluent distribution piping and d-boxes should be designed so that an air space is provided.

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Pump Systems

- Pump system utilized when a gravity system cannot be installed
 - Single pump with 24 hour emergency storage or dual pumps
 - Manhole to grade
 - High level alarm
 - Protection from freezing

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Pump Systems/Mandatory Dosing

- Dosing required for large leaching systems by means of pumps, siphon or other approved method
 - 2,000 GPD (large system) or greater with 600 linear feet of leaching system
 - Dual alternating pumps
 - High level alarm
 - Manhole to grade
 - Dosing volume of 3-6 cycles per day or 50% minimum of distribution piping volume
 - Dosing chamber shall have access manholes to grade
 - Protection from freezing

Section VI Effluent Distribution, Pump Systems

- Subsection C pg. 33-35
 - Pump systems can utilize timed-dosed systems or volume-dosed pump systems.
 - Caution that pump systems shall avoid dosing large volumes of effluent into leaching systems with limited internal storage capacities.
 - Recommend that dosed volumes not exceed 20% of the leaching system internal storage capacity.
 - Proprietary leaching system companies shall provide DPH information on internal storage capacities of their products as part of their submittals pursuant to Section VIII G.

Sewage Flows, Septic and Grease
Interceptor Tanks , Distribution,
Tech Standards Section IV - VI

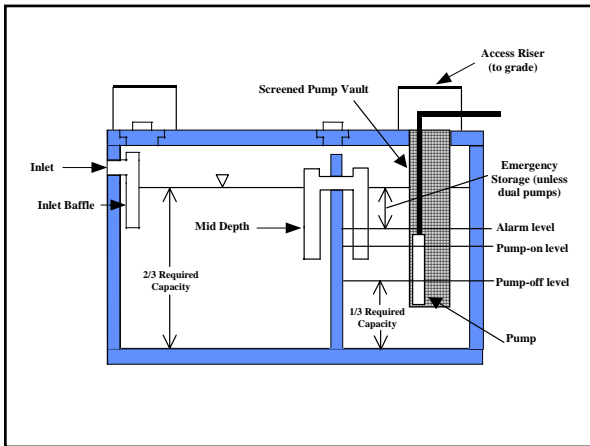
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Section VI Effluent Distribution, Pump Systems

- Subsection C pg. 33-35
 - Combination septic tank/pump chambers must use tee baffle piping so that drawdown occurs in second compartment only.
 - See diagram of 2-compartment tank with mid-depth connection via tee-baffles for use in combination septic tank/pump chamber to allow drawdown in second compartment only.

Sewage Flows, Septic and Grease
Interceptor Tanks , Distribution,
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Section VI Effluent Distribution, Pump Systems

- Subsection C pg. 33-35
 - Pump systems can utilize pressure transducers, mechanical float switches etc.
 - Pump chamber risers have a minimum inside diameter of 24 inches for chambers more than 24 inches below finished grade.

Sewage Flows, Septic and Grease
Interceptor Tanks, Distribution,
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Effluent Distribution, Pump Systems & Air Injection Process

- Pump chambers under vehicular travel areas: Riser and cover assemblies must be rated for H-20 loads.
- DEP has banned the sale of mercury float switches in CT.

Sewage Flows, Septic and Grease
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Distribution of Septic Tank Effluent

- Leaching systems must have access ports
 - D-box
 - Cleanouts (galleries, pits)
 - Capped sanitary tees extended to grade

Sewage Flows, Septic and Grease
Interceptor Tanks , Distribution,
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Access Ports





Access Ports

- Single d-box feeding rows at same elevation will be considered an access point for both rows.
- Leaching system with rows at the same elevation shall have ends connected whenever feasible.
- Access points on large (2000 GPD and greater) and non-residential leaching systems shall be extended to grade in paved areas.

Sewage Flows, Septic and Grease
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Access Port Level System



Access Ports Step System



Effluent Distribution, Pump Systems & Air Injection Process (pg. 34)

- Low pressure distribution systems: PE design required. Design must include access & flushing provisions, ability to check pressure in lines, pressure filters, orifice shields, manifold access, and pipe info: size, specs, holes etc. PE must stipulate O & M requirements (i.e., flushing of lines, checking pressure heads).



Effluent Distribution, Pump Systems & Air Injection Process (pg. 34)

- Raw sewage pumps/vaults below basement slab elevation are considered part of the SSDS unless it is in a sealed pit or otherwise designed to contain leakage in the basement. Exterior raw sewage pump systems must be approved by DPH.



Leaching System Enhancement/Rejuvenation (pg. 35)

- Soil Air Systems
 - Adding air to a SSDS
 - Permit required
 - Must provide the minimum separation above ledge rock and groundwater
 - Effluent filter can be removed if designer approves



Leaching System Clogging Break-up

- Terra-lift process
 - Permit required
 - Must provide the minimum separation above ledge rock and groundwater
